

Mathematical modelling of a silicon carbide (SiC) pilot furnace

Elkem is developing a new concept to eliminate all direct CO₂ emissions from the silicon (Si) production process. The new concept has been developed based on carbon looping, where carbon oxides in the process off-gases are captured, converted to solid carbon, and reused in the process. When successful, this will become a game changer for the global silicon industry. The new process is made up of many parts, such as high temperature furnaces, gas conversion, and material agglomeration, each of which provide interesting and complex challenges.

At this study group we will focus on the high temperature furnaces. To learn more about the sub reactions that happen within the silicon furnace, we are designing a new furnace which produces silicon carbide (SiC) from the raw materials of solid carbon (C) and quartz (SiO₂). The new concept furnace is still in the experimental stages. We aim to first develop a pilot sized SiC furnace which should reflect the capabilities of the full industrial sized furnace at a smaller scale.

During the study group, the goal is to create a mathematical model of the SiC pilot furnace. The model should describe the solid and gas movement, reaction kinetics, and temperature distribution within the pilot furnace. The goal is to determine the best furnace design which will meet the requirements for SiC production whilst providing necessary control over the off gases produced in the process.